## Dalia Cervantes

The quantum chiral Minkowski superspace and quadratic deformation on Minkowski space
We give a quantum deformation of the chiral Minkowski superspace in four dimensions embedded as the big cell into the quantum super Grassmannian $G(2,4)$. Finally we compute explicitly a star product on Minkowski space whose Poisson bracket is quadratic. This product defined on the polynomials can be extended differentiably.

## Vyacheslav Futorny

## Representations of Weyl algebras

We will discuss classification of simple weight modules over infi nite dimensional Weyl algebrasand realize them using the action on certain localizations of the polynomial ring. This is a joint work with D.Grantcharov and V.Mazorchuk.

## Alexandre Grishkov

Commutative automorphic loops

## Eduardo Hernández Huerta

Algebra de octonios bicomplejos

## Iryna Kashuba

## Deformations of Jordan algebras of dimension four

Let $k$ be an algebraically closed field, $n$ be a positive integer and $\mathbb{A}=\mathbb{A}_{k}^{n^{3}}$ be a $n^{3}$-dimensional affine space. We consider a point $c$ of $\mathbb{A}$ such that $c=\left\{c_{i j}^{h}\right\}$ gives a collection of structure constants defining a Jordan $k$-algebra. The set of all such points of $\mathbb{A}$ defines an algebraic subvariety $J_{n} \subset \mathbb{A}$. The group $G L_{n}$ acts on $J o r_{n}$ by so-called "transport of structure" action, moreover $G L_{n}$-orbits of this action are in one-to-one correspondence with the isomorphism classes of $n$-dimensional Jordan algebras. An algebra $J_{2}$ is called a deformation of an algebra $J_{1}$ if the orbit $J_{1}^{G L_{n}}$ belongs to the Zariski-closure of the orbit $J_{2}^{G L_{n}}$. We give complete description of all deformations of Jordan algebras of dimension 4. In particular we obtain the decomposition of $\mathrm{Jor}_{4}$ into irreducible components. This a joint work with Maria Eugenia Martin.

## Vladislav K. Kharchenko

## Primitively generated braided Hopf algebras

The braided Hopf algebras appeared firstly in the famous paper by Milnor and Moore as graded Hopf algebras, and then as universal enveloping algebras of colored super-algebras. A more general concept of "generalized Lie algebra" related to an involutive braiding (a symmetry) has been introduced by D. Gurevich and appeared later in the categorical context in the paper by Ju. Manin. The universal enveloping algebra construction then provided a new class of braided Hopf algebras. More generally, braided Hopf algebras are Hopf algebras in braided tensor categories. A standard way to obtain a braided tensor category is to consider all modules over a quasitriangular Hopf algebra or all comodules over coquasitriangular Hopf algebra.

We discuss possible generalizations of the Cartier-Kostant theorem for braided Hopf algebras. By definition a connected braided coalgebra $C$ is cosymmetric if the image of the linearization map defined by M. Sweedler is contained in the Nichols algebra defined by the braided space of primitive elements. We show that a connected braided Hopf algebra $H$ is cosymmetric if and only if it is strictly generated by the primitive elements: $H_{n}=H_{1}^{n}$. Additionally, all Hopf subalgebras of $H$ and all homomorphic images of $H$ in the related tensor category are cosymmetric, while all biideals are generated by the primitive elements, provided that the braiding is diagonal or the category is the category of left comodules over coquasitriangular cosemisimple bialgebra. The latter statement somehow defines a category equivalence to some algebraic structure on the space of primitive elements, which is naturally to consider as a "quantum Lie algebra". From this point of view, we discuss approaches of S. L. Woronowicz and Ardizzoni, and consider in more detail the case of involutive braidings.

## Sara Madariaga

## Polynomial identities for tangent algebras of monoassociative loops

We study a particular variety of Sabinin algebras: tangent algebras for monoassociative loops, which generalize Lie, Malcev and Bol algebras. These algebras are the most general of the local algebras associated to closed hexagonal 3 -webs, widely studied in differential geometry. Our study was focused on finding a defining set of multilinear polynomial identities for this variety by using the primitive operations defined by Shestakov and Umirbaev and computational techniques based on representation theory of the symmetric group.

## Maria de Lourdes Merlini Giuliani <br> Half Isomorphism in Categories of Loops: A not so-trivial-matter

A half-isomorphism $\varphi: G \longrightarrow K$ between multiplicative systems $G$ and $K$ is a bijection from $G$ onto $K$ such that $\varphi(a b) \in\{\varphi(a) \varphi(b), \varphi(b) \varphi(a)\}$ for any $a, b \in G$. It was shown by W.R. Scott [1] that if $G$ is a group then $\varphi$ is either an isomorphism or an anti-isomorphism. This is used to prove that a finite group is determined by its group determinant. I will show that every half-isomorphism between Moufang loops of odd order is either an isomorphism or an anti-isomorphism. Such a result in general does not carry over to loops, Moufang loops of even order including Chein loops.

This is a joint work with S.M.Gagola III.

## References

[1] W.R. Scott, Half-homomorphisms of groups, Proc. Amer. Math. Soc. 8 (1957), 1141-1144.
[2] S.M. Gagola III and M.L.M. Giuliani, Half-isomorphisms of Moufang loops of odd order, J. Algebra Appl., 11 (2012), no. 5, to appear.

## Jacob Mostovoy

Sabinin algebras
In this expository talk I will discuss various definitions of a Sabinin algebra.

## Péter T. Nagy (joint with Karl Strambach) <br> Holonomy theory of differentiable families of loops

L. V. Sabinin introduced for differentiable families of loops on a differentiable manifold the notion of holonomy transformation ([1], XII.2.5 Remark). Extending his definition we define the abstract holonomy group of a differentiable familiy $S$ of loops on a differentiable manifold $M$ and show that the holonomy groups with respect to different points are isomorphic. Moreover, we characterize families of loops having a trivial holonomy group or a holonomy group coinciding with the inner mapping group. We associate to $S$ an affine connection $\nabla$ on the linear frame bundle of $M$. If the loops of $S$ are isotopic, we explicitly determine the horizontal subbundle of the tangent bundle of $M$. Assuming that the left translations of the loops belonging to the family $S$ generates a Lie group we prove that the classical holonomy group of the associated connection $\nabla$ is the subgroup of the topological closure of the abstract holonomy group. If $S$ is a geodesic family of diffeomorphisms, then we may introduce even the geodesic holonomy group using geodesic polygons. In this case it turns out, that the abstract, classical and geodesic holonomy groups are isomorphic.

## Reference

[1] P. O. Miheev and L. V. Sabinin, Quasigroups and Differential Geometry, Chap. XII in Quasigroups and Loops: Theory and Applications, Sigma Series in Pure Math. 8, Heldermann, Berlin (1990), 357-430.

## Zbigniew Oziewicz

## Category of loops, homogeneous spaces, and link problem

Lev Vasilievich Sabinin observed and proved in 1972 important theorem: category of homogeneous spaces with sections (reductants), is equivalent to category of loops with their transassociant groups. The purpose of this paper is review this important Sabinins theorem and relate to the link problem on homogeneous spaces. Given homogeneous space $G / R$ and $a, b \in G / R$, the link problem is to determine explicitly all group elements $g(a, b) \in G$, such that $g(a, a)=\mathrm{id} \in G$, and $g(a, b) b=a$. Such group element $g(a, b)$ is said to be a boost. We conjecture that subgroup $R$ is normal if and only if the link problem possess the unique solution. Otherwise $G / R$ is a non-associative loop. Our statement is illustrated in all details on example of the isometry group considered by Sabinin and Miheev in 1993.

## References

[1] L.V. Sabinin L, On the equivalence of categories of loops and homogeneous spaces, Soviet Math. Dokl. 13 (1972) 970974.
[2] L.V. Sabinin and P. O. Miheev, On the law of addition of velocities in Special Relativity, Russian Mathematical Surveys 48 (1993)
[3] L.V. Sabinin, Smooth Quasigroups and Loops, 1999.

## José María Pérez Izquierdo

## Graphical calculus in Non-associative Lie Theory

Graphical calculus allows diagrammatical descriptions of tensor categories. When coassociativity is not required graphical calculus is preferable to Sweedler notation. After reviewing the tremendous influence of Lev V. Sabinin in the developement of Non-associative Lie Theory, we will use graphical calculus in this context to show that any bialgebra deformation of the universal enveloping algebra of the traceless octonions that satisfies the dual of the left and right Moufang identities must be coassociative and cocommutative. This talk is based on a joint work with I. P. Shestakov.

## Liudmila Sabinina

## Karl Strambach

## Abstract version of Sabinins theory of transitive families of permutations

In the work of L.V. Sabinin there is a stream of research dedicated to the study of the relations between the algebraic properties of transitive families of diffeomorphisms and the curvature properties of the differentiable geometric structures on which the transitive families act. We model an abstract version of Sabinins of transitive families of permutations on a set such that to any point corresponds a left loop nd give an abstract definition of Sabinins ternary operation which is strictly related to the notion of a transitive family of permutations.

There exist transitive families $\mathcal{S}$ in the sense of our definition such that the family of loops associated with $\mathcal{S}$ contains non-isotopic left loops. For transitive families $\mathcal{S}$ of permutations we mainly investigate under which conditions the family of left loops associated with $\mathcal{S}$ consists of right isotopic, left isotopic or isomorphic loops and when $\mathcal{S}$ allows translative mappings.

Sabinin introduced for transitive families $\mathcal{S}$ of diffeomorphisms the notion a holonomy transformation. Extending his definition we define for any abstract transitive family of permutations a holonomy group $\mathrm{Hol}_{e}^{\mathcal{S}}$ with respect to a point e and show that the holonomy groups with respect to different points are isomorphic. Moreover, we characterize those transitive families of permutations having a trivial holonomy group or a holonomy group coinciding with the inner mapping group.

The differential theoretical version of this abstract theory will be treated in the talk of Peter T. Nagy.

## Gregor Weingart

## Campbell-Baker-Hausdorff formula for loops

Gregory P. Wene<br>Permutations for the Knuth cube

